LUDLUM MODEL 3000 SURVEY METER
USER'S MANUAL

December 2015

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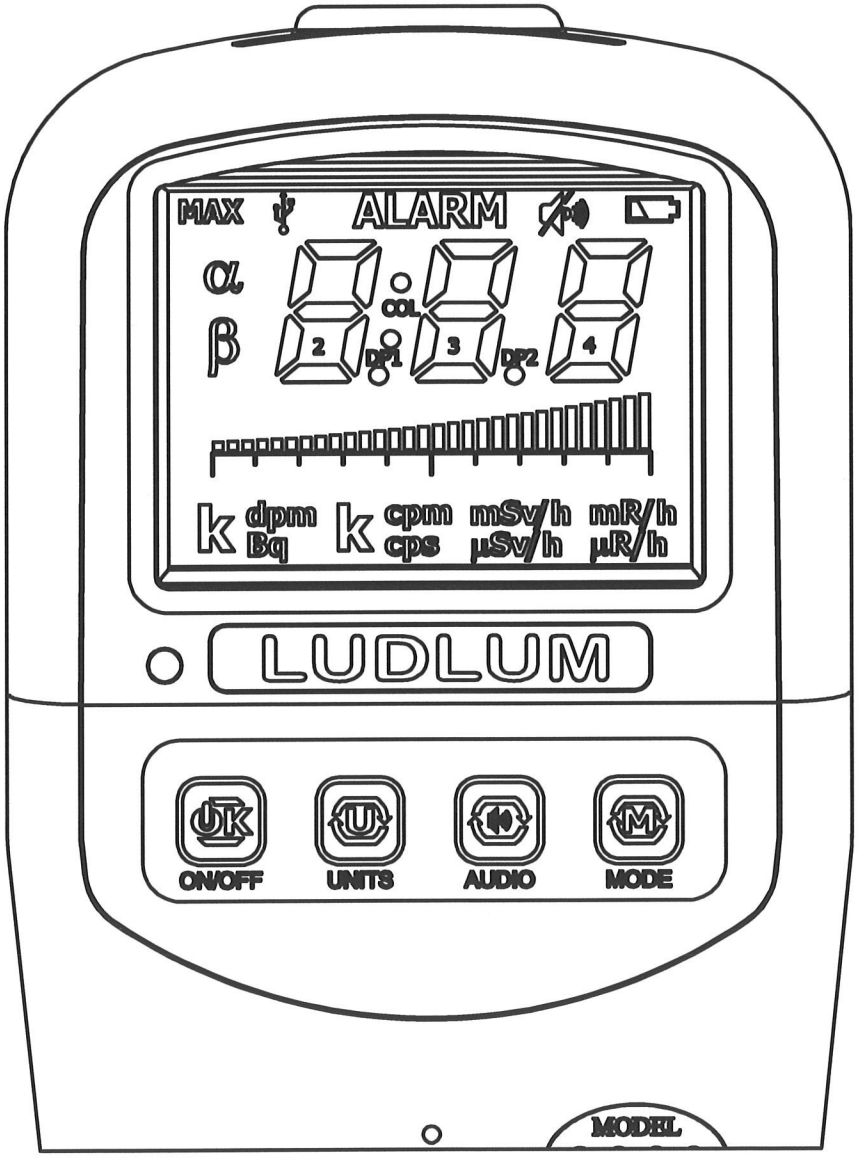
LUDLUM MEASUREMENTS, INC
501 OAK STREET, P.O. BOX 810
SWEETWATER, TEXAS 79556
325-235-5494, FAX: 325-235-4672

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	5/26/13	DDW
2	ADD NOTES	1/25/14	DDW
3	ADD CABLE CLAMP	4/16/14	DDW



DWN	DATE	CHK	DATE	APP	DATE
DDW	4/21/14				4/21/14

DWG NUM: 4498-409.iam | SCALE: 1:1

TITLE M 3000 FRONT PANEL

LUDLUM MEASUREMENTS, INC.
501 OAK STREET
SWEETWATER, TEXAS 79556

SERIES 498 | **SHEET** 409K

Table of Contents

Introduction *1*

Getting Started *2*

Unpacking and Repacking 2-1
Battery Installation 2-1
Instrument Operational Test 2-2
Sigma Audio 2-3
Detector Failure Diagnostic 2-4
Detector Over Range 2-4
Detector Overload 2-5
Instrument Use and Controls 2-5
RATE Mode Operation 2-6
MAX Mode Operation 2-7
COUNT Mode Operation 2-8

Specifications *3*

Setup Mode *4*

Setup Overview 4-1
Default Setup Values 4-2
Entering Setup Mode 4-3
Setup Mode Operation 4-4

Safety Considerations *5*

Environmental Conditions for Normal Use 5-1
Warning Markings and Symbols 5-1
Cleaning and Maintenance Precautions 5-2

Revision History *6*

Recycling *7*

Standard Parts List *8*

Section

1

Introduction

The Model 3000 is an ergonomic, lightweight instrument, which can be used for radiation survey purposes. It features the ability to measure radiation in count rate, exposure rate/dose, activity rate, integrated exposure/dose, time-averaged rates, and scaler counts. The Model 3000 utilizes an external radiation detector to detect alpha, beta, or gamma radiation.

Three modes of operation are available for the Model 3000 – RATE, MAX, and COUNT. RATE mode operation will display the current count, exposure, or activity rate. MAX mode is used to capture the highest count, activity, or exposure rate detected – useful for finding a peak rate, or frisking when the display is not visible. Two sets of units (primary and secondary) for RATE and MAX modes can be chosen from among cps, cpm, Bq, dpm, R/h, or Sv/h. The user can switch between these two units by simply pressing the Units button.

COUNT mode allows the user to perform a count for a predetermined time. Depending on the count units chosen, the result can be a scaler count (in counts or disintegrations), a time-averaged rate (cpm, dpm, Bq, cps), a time-averaged exposure or dose (R/h, Sv/h), or an integrated exposure or dose (R or Sv).

The instrument features a large backlit LCD (liquid crystal display), a piercing audio warning, and easy, intuitive use. The unit body is made of lightweight but durable plastic. It is intended for outdoor use and can resist splashing water. The foam grip provides a comfortable ergonomic grip, but may be removed for ease of decontamination.

The display will be automatically backlit if light levels are low. The display backlight can also be configured for "Continuous On" operation. RATE and MAX modes can be silent or utilize a "click" audio; the "click" audio is always silent during COUNT mode. A "sigma" audio mode can be enabled (disabling the "click" audio) when scintillator detectors are used, and this mode makes it easy for the user to find small increases above the background radiation level. In this

mode, the instrument measures background for 8 seconds after power-up, and then beeps whenever the rate increases by a small amount. Users are freed from watching the numeric value to "find" something. They can simply listen for multiple beeps.

Setup of the instrument is accomplished through the front-panel buttons, or through software available from Ludlum Measurements. The advanced user or administrator can set:

- Calibration Constant
- Dead Time Correction
- Efficiency
- High Voltage
- Pulse Threshold
- Detector Current Overload Threshold
- Loss of Count Alarm Time
- Primary and Secondary Units
- Primary and Secondary Minimum and Maximum Displays
- Primary and Secondary Unit Alarm Levels
- Primary and Secondary Count Units
- Primary and Secondary Count Units Minimum Displays
- Primary and Secondary Count Alarm Levels
- Response Time
- Auto-Response Rate (**F**ast or **S**low)
- Available Operational Modes
- Count Time
- Auto Shutdown Time
- Backlight Threshold
- Sigma or Click Audio Mode

Front-panel setup can be disabled via the internal switch on the Model 3000 in order to protect settings from inadvertent changes.

The unit is operated with four alkaline AA batteries for operation from -20 to 50 °C (-5 to 122 °F). Battery life is approximately 750 hours under normal usage. A low-battery indicator on the LCD warns when less than 16 hours of battery life remain.

The Model 3000 may optionally be provided with a 1/8-inch stereo headphone jack that would allow for headphone use for audio output. It is located to the left of the detector connector.

Section

2

Getting Started

Unpacking and Repacking

Remove the calibration certificate and place it in a secure location. Remove the instrument and ensure that all of the items listed on the packing list are in the carton. Check individual item serial numbers and ensure calibration certificates match between instruments and detectors (if applicable). The Model 3000 serial number is located on a label on the front side of the unit.

To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment.

Every returned instrument must be accompanied by an **Instrument Return Form**, which can be downloaded from the Ludlum website at www.ludlums.com. Find the form by clicking the "Support" tab and selecting "Repair and Calibration" from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.

Battery Installation

A low-battery indicator appears at the top of the LCD when less than 16 hours of battery life remain. When this indicator is present, follow these steps to replace the four standard AA batteries:

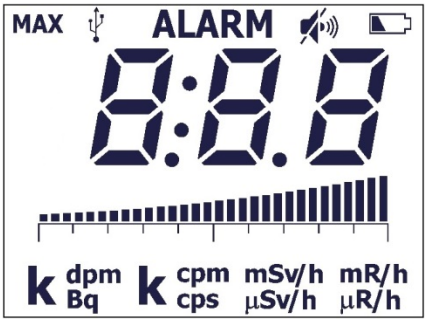
1. Turn the instrument over so that the bottom of the instrument is facing up.
2. Use a straight medium-sized screwdriver to turn the single screw on the battery cover one-quarter turn counter-clockwise.
3. Release and remove the battery cover.
4. Replace four each AA batteries.
5. Replace the cover and turn screw one quarter of a turn clockwise to secure.

Instrument Operational Test

Turn the instrument ON by pressing the ON/ACK button for about a second, and then releasing.

The instrument should activate all the LCD segments and the audio. Observe the device during this time. If any LCD segments are missing, or audio fails to work, the device is in need of repair. Please refer to Figure 1 below.

Figure 1: Startup display for Model 3000, with all LCD segments shown.



The instrument then displays the firmware version. Please refer to Figure 2 below.

Figure 2: Firmware version display.

The instrument will then move to normal operation, displaying the current rate for the Primary units (default: cpm).

If the Sigma Audio option is selected, the unit will display a countdown from 8 to 1 (in seconds) as the unit measures background radiation levels.

The user may select the Secondary units (default: mR/h) by pressing the Units button.

Ensure that the low-battery indicator is not present. If the low-battery indicator is present, replace the batteries as soon as possible. Should the instrument detect a battery voltage that is high enough to power on, but too low to safely operate, the display will blank and the low-battery icon will flash. Normal operation will not be available until the batteries have been replaced. Under extreme low-battery conditions, be aware that the unit may not even turn on or may turn itself off abruptly.

A reference reading with a check source, 1 μCi (37 kBq) of ^{137}Cs for example, should be obtained at the time the instrument is received in the field. Small check sources of radiation are available from Ludlum Measurements. While exempt from many regulations because of their small size, these sources are large enough to produce a response on this instrument. If this procedure is done routinely with the same radiation source, instrument malfunction may be detected when anomalous readings are observed. If at any time the instrument fails to read within 20% of the reference reading when using the same check source, it should be sent to a calibration facility for recalibration and/or repair.

Example log reading:

Check Source #_____ Rate _____ Units _____

Once this procedure has been completed, the instrument is ready for use.

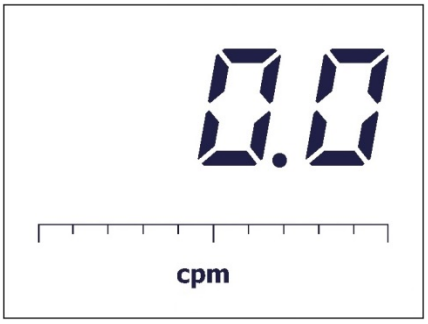
Sigma Audio

The Ludlum Model 3000 has the standard "click" audio that is widely used by radiation instruments. However, it also has a Sigma Audio mode that can be enabled to change the audio sound. This mode is useful for scintillation detectors because their high count rate makes the "click" audio less useful. In the sigma audio mode, the instrument measures the background radiation alarm for eight seconds on power-up, and then automatically sets a low threshold rate above the background rate. Then the instrument will produce a beep any time that the instrument "sees" more than this threshold value. The user doesn't need to watch the display to find a small increase over background, the user can just listen for multiple beeps. Thus the unit has an audio alarm that, on power-up, adjusts to just above the current background level, and provides a sensitive audio indication to the user. Note that this audio alarm can also work in conjunction with the fixed alarm, i.e. the user can have both a floating audio alarm (resulting in audio beeps) based on the background level, and a fixed tone audio and a steady ALARM icon when a predetermined fixed alarm level is exceeded.

Detector Failure Diagnostic

Note that the Model 3000 has its own diagnostic tests to ensure that the detector is functioning correctly. The Model 3000 can detect when the radiation detector is malfunctioning and will flash the display to indicate a fault. If the detector stops detecting radiation for a settable number of seconds, the Model 3000 will flash a zero reading for the currently selected units. This indication is common if the unit is powered up without a detector connected. If this indication is observed with a connected detector, remove the unit from service and have it evaluated by a qualified repair and calibration technician.

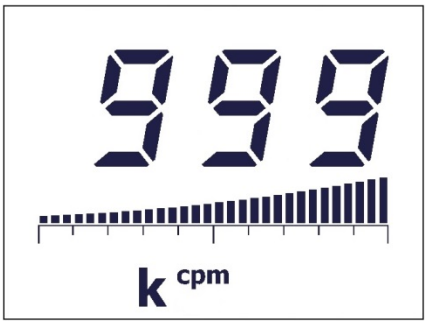
Figure 3: Detector Failure display (shown for cpm); will also flash.



Detector Over Range

If the detector is exposed to high levels of radiation or has an internal malfunction that causes it to count high or excessively, the unit flashes the maximum rate (999) for the currently selected units as a warning. The user should ensure whether this is being caused by a high radiation field or by internal malfunction. With some detectors, this display could be an indicator of a light leak, possibly caused by a puncture or tear in the detector face. If a Maximum Display parameter is set, then it is possible for the display to flash the Maximum Display value under this condition.

Figure 4: Detector Over Range (shown for cpm); will also flash.



Detector Overload

As another diagnostic test, the Model 3000 monitors the HV supply's detector current. A current overload threshold, in microamps, can be set via Setup Mode. (A setting of 0 disables this alarm.) In general, this alarm setting can be used to detect when there is some detector failure, a cable failure, or a possible high level of radiation. When this alarm is triggered, the LCD will display OL and an alarm tone will sound. Once the detector current goes below the threshold, the Model 3000 will return to normal operation.

Figure 5: Detector Overload Alarm; will also flash.

Instrument Use and Controls

With three front-panel buttons, the Ludlum Model 3000 is simple and easy to use with minimal training required. Default operation is RATE mode, and the display shows the current count rate using the Primary units. Pressing the UNITS button will switch between Primary and Secondary units. Pressing the MODE button will switch the instrument to MAX mode, which will display the highest count rate detected. Pressing the MODE button again will switch it to COUNT mode, which will display the COUNT timer. Note that either or both of the MAX and COUNT modes can be locked out in the setup process.

See the Model 3000 drawing at the beginning of this manual to reference the following controls:

ON/ACK button: Used to power the Model 3000 ON and OFF, reset MAX mode, start/reset the COUNT Timer, and acknowledge audio alarms.

- Power On: Press for approximately one second and release (all LCD segments will activate, and firmware version will be shown).
- Power Off: Press for approximately five seconds. The display will show a 3, 2, 1 countdown for the final three seconds of shutdown. Releasing the ON/ACK button during shutdown will return the device to the previous state of operation. At completion of the shutdown count, the LCD will go blank.

- Normal Operation: Will reset MAX mode display, start/reset COUNT Timer in COUNT mode, and acknowledge/silence alarms in all modes of operation. When Sigma Audio is enabled, pressing the ON/ACK button will take a new background reading and update the Sigma Audio level.

UNITS button: Used to switch between Primary and Secondary units in RATE and MAX modes. In COUNT mode, the UNITS button will switch between Primary and Secondary units unless a countdown is active. The UNITS button is disabled during an active countdown.

AUDIO button: Used to toggle the click audio ON or OFF. Click audio defaults to ON when the unit is powered up. When Sigma Audio is enabled, pressing the AUDIO button will toggle the Sigma Audio beep ON and OFF. The AUDIO button is disabled during an active countdown.

MODE button: Used to advance between the three operating modes, RATE, MAX, and COUNT. Note that MAX and/or COUNT mode may be disabled from use by the administrator or calibrator.

RATE Mode Operation

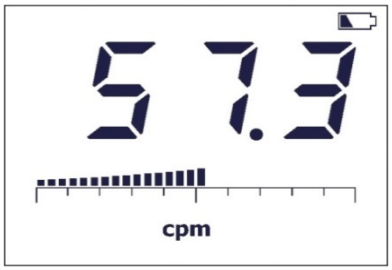
In RATE mode, the current count rate will be displayed.

Pressing the UNITS button will switch the displayed value between the Primary and Secondary Units.

Pressing the AUDIO button will turn the "click" audio on/off. When Sigma Audio is enabled, pressing the AUDIO button will toggle the Sigma Audio beep on/off.

If an alarm condition is present, pressing the ON/ACK button will acknowledge and turn off the continuous tone alarm audio. Under an alarm condition, the ALARM display indicator will remain on. Alarms are non-latching in RATE mode. When Sigma Audio is enabled, and an alarm condition is not present, pressing the ON/ACK button will reset the Sigma Audio alarm level.

Figure 6: RATE mode display showing typical background radiation rate and the low-battery icon.



MAX Mode Operation

While in MAX mode, the highest detected count rate (since the last reset) is displayed. The word MAX will be displayed when in MAX mode.

Pressing the UNITS button will switch the displayed value between the Primary and Secondary Units.

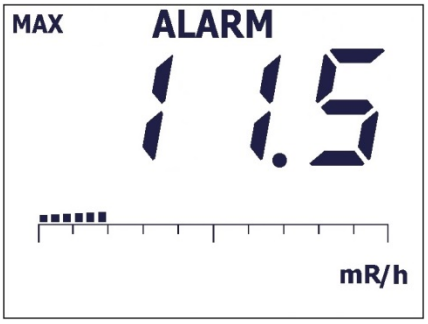
Pressing the AUDIO button will turn the "click" audio on/off. . When Sigma Audio is enabled, pressing the AUDIO button will toggle the Sigma Audio beep on/off.

Under a non-alarm condition, pressing the ON/ACK button will reset the display. When Sigma Audio is enabled, pressing the ON/ACK button will reset the Sigma Audio alarm level.

If an alarm condition is present, pressing the ON/ACK button once will acknowledge and turn off the continuous tone alarm audio. (The "click" audio will remain as selected under non-alarm conditions.) Pressing the ON/ACK button a second time will reset the display and clear the alarm condition. Under an alarm condition, the ALARM display indicator will remain on. Alarms in MAX mode latch with the display.

If other operational modes are available, pressing the MODE button will move to the next available operational mode.

Figure 7: MAX mode operation display with ALARM indicator.



COUNT Mode Operation

When entering COUNT Mode from another operational mode, the currently selected COUNT Units will be displayed for approximately one second. The purpose of COUNT mode is to count for a predetermined amount of time, and to display the results on the display. Note that the predetermined count time can be from 1 second to 10 minutes, or can be set to zero to enable continuous counting until stopped by the user.

Count mode operation is very flexible, depending on the units chosen. A common choice is for the count mode to just perform a scaler count for a specified time, with a resulting answer in counts (equaling detected radiation events). If a result in terms of activity is desired, the scaler count can also be in units of "d" or disintegrations. But if the count units are chosen to be cpm or cps, then the resulting answer is an averaged count rate over the time interval. Similarly, if count units of Bq or dpm are chosen, the resulting answer is an averaged disintegration rate.

- ✓ NOTE: If the user desires the instrument to show results in terms of disintegrations/area (eg. dpm/100cm^2 or Bq/cm^2), then the appropriate factor should be placed in the Efficiency parameter.

Other choices are to have count mode units of R/h or Sv/h, in which case the COUNT mode result is an averaged exposure or dose rate. But if count mode units of R or Sv are chosen, the result is shown in accumulated exposure or accumulated dose over the chosen count time. The following tables lists the possibilities:

UNITS	RESULT
c	counts per count time
d	disintegrations per count time
cpm, cps	count rate averaged over the count time
dpm, Bq	disintegration rate, averaged over the count time
R/h, Sv/h	exposure or dose rate, averaged over the count time
R, Sv	integrated exposure or dose over the count time

Audio 'clicks' are disabled in COUNT mode.

In COUNT mode, operation depends on the current state of the Count Timer.

When the Count Timer is Ready:

- The display will show the Count Time.
- Pressing the UNITS button will switch between the Primary and Secondary Count Units. The newly selected Count Units will be displayed for approximately one second, and the display will then return to the Count Timer.
- Pressing the ON/ACK button starts the Count Timer.
- If other operational modes are available, pressing the MODE button will move to the next available operational mode.

When the Count Timer is active:

- The display will show the Count Time remaining.
- Pressing the ON/ACK button will reset the Count Timer.
- The UNITS button is disabled.
- If an alarm condition occurs, the display will alternate between the Count Time remaining and the Count Rate. The ALARM display indicator will turn on. Alarms are latching in COUNT mode.
- If other operational modes are available, pressing the MODE button will cancel the current Count Timer and move to the next available operational mode.

When the Count Timer has finished:

- The display will show either the accumulated total for c, d, R, and Sv, or the timed ratemeter average for cps, cpm, Bq, dpm, or the average exposure or average dose in R/h and Sv/h.
- Pressing the UNITS button will switch between the Primary and Secondary Count Units.
- Under a non-alarm condition, pressing the ON/ACK button will reset the Count Timer.
- If an alarm condition occurred during the Timed Count, a continuous audio tone will sound, and the ALARM display indicator will turn on. Pressing the ON/ACK button once will acknowledge and turn off the continuous tone alarm audio. Pressing the ON/ACK button a second time will clear the alarm condition and reset the Count Timer. Alarms are latching in COUNT mode.
- If other operational modes are available, pressing the MODE button will move to the next available operational mode.

Figure 8: COUNT mode operation showing COUNT Timer of 5 minutes, 30 seconds.

Section

3

Specifications

Detector: may be Geiger-Mueller (GM), scintillator, or proportional

HV Range: 400-1500 Vdc

Threshold Range: 4-100 mVdc

Resolving Time: approximately 5 μsec as defined by IEC 60325

Alarms: count rate, exposure/dose, and scaler alarm setpoints adjustable over the display range

Overload: high count rate saturation protection prevents false display of lower count rates

Zero Protection: after a user-settable number of seconds of no pulses from detector, unit will flash a zero reading and the alarm audio will be triggered

LCD Display: 3-digit LCD with large 20 mm (0.8 in.) digits, (k)cps, (k)cpm, (k)Bq, (k)dpm, (μ)(m)R(/h), (μ)(m)Sv(/h), low-battery indicator, MAX, ALARM, AUDIO

Display Range:

- 0.0 cps to 99.9 kcps
- 0.00 cpm to 999 kcpm
- 0.00 Bq to 99.9 kBq
- 0.00 dpm to 999 kdpm
- 0.00 μR/h to 999 R/h
- 0.00 μSv/h to 999 Sv/h

Headphone Jack (optional): 1/8 inch stereo jack for use with headphones for audio output. It is located to the left of the detector connector.

Backlight: built-in ambient light sensor automatically activates low-power LED backlight, unless internal dip switch is set to continuous-On (will reduce battery life)

User Controls:

- ON/OFF/ACK – press to turn ON, tap to acknowledge alarms and silence alarm tone, press to reset Sigma Audio alarm, hold for OFF
- MODE – alternates between NORMAL (count rate), MAX (captures peak rate), and COUNT (user-selectable preset count time from 0 to 10 minutes)
- AUDIO – turn "click" audio on/off, turn Sigma Audio beep on/off
- UNITS – changes the units from count rate (cpm, cps), to dose/exposure (μSv/h, mR/h) or disintegration (dpm/Bq)

Response Time: user-selectable from 1 to 60 seconds, or Auto-Response Rate FAST or SLOW

Audio: greater than 75 dB at 0.6 m (2 ft), approximately 4.5 kHz

Power: four alkaline "AA" batteries

Battery Life: approximately 750 hours of operation (as low as 100 hours with backlight configured for continuous-on), 16-hour low-battery warning

Maximum Current: 35 mAdc

Construction: high-impact plastic with water-resistant rubber seals and separate battery compartment

Temperature Range: -20 to 50 ˚C (-5 to 122 ˚F), may be certified for operation from -40 to 65 ˚C (-40 to 150 ˚F)

Environmental Rating: NEMA (National Electrical Manufacturers Association) rating of 4x or IP (Ingress Protection) rating of 65

Size: 16.5 x 11.4 x 21.6 cm (6.5 x 4.5 x 8.5 in.) (H x W x L)

Weight: 0.9 kg (2.0 lb)

Section

4

Setup Mode

Warning!

Only advanced users or administrators should consider changing any of the parameters in the following section. Incorrect settings could jeopardize the safety of users depending on this instrument.

Setup Overview

Your instrument has been shipped from Ludlum Measurements only after passing electronic checkout, a 24-hour burn-in process, and a careful calibration process. Calibration papers are supplied with each instrument shipped from Ludlum Measurements.

Recalibration should be accomplished after maintenance or adjustments have been performed on the instrument. Recalibration is not normally required following instrument cleaning or battery replacement. Recalibration does not require any special tools or software to perform.

Ludlum Measurements offers a full-service repair and calibration department. Not only do we repair and calibrate our own instruments, we also service most other manufacturers' instruments. Calibration procedures are available upon request for customers who choose to calibrate their own instruments.

Note:

Ludlum Measurements, Inc. recommends recalibration at intervals no greater than one year, assuming that regular operational checks are performed. Check the appropriate local, state, and federal regulations to determine required recalibration intervals.

Default Setup Values

	Setup Parameter	Default Value	Notes
P1-1	Calibration Constant Mantissa	200	200 e^6 Counts/R
P1-2	Calibration Constant Exponent	06	
P1-3	Dead Time Correction	0	Scintillator 5-10 μsec GM Tube 50-100
P1-4	Efficiency	15.0	Efficiency %
P1-5	High Voltage Setpoint	900	Volts
P1-6	Pulser Threshold	35	millivolts
P1-7	Detector Current Overload Threshold	100	microamps
P1-8	Loss of Count Alarm Time	60	Seconds
P2-1	Primary Units and Minimum Display	000 cpm	
P2-2	Primary Units Maximum Display	999 kcpm	
P2-3	Primary Units RATE/ MAX Mode Alarm Point	000	Disabled
P2-4	Primary Count Units and Minimum Display	000 c	
P2-5	Primary Count Alarm Point	000	Disabled
P3-1	Secondary Units and Minimum Display	0.00 mR/h	Non-SI exposure rate
P3-2	Secondary Units and Maximum Display	999 mR/hr	
P3-3	Secondary Units RATE/ MAX Mode Alarm Point	000	Disabled
P3-4	Secondary Count Units and Minimum Display	0.00 mR	Non-SI exposure
P3-5	Secondary Count Alarm Point	000	Disabled
P4-1	Response Time	0	Enable Auto Response
P4-2	Auto-Response Rate	S	Slow Auto Response
P4-3	Operational Modes	0	All Modes Available
P4-4	Count Time	1:00	One Minute
P4-5	Auto Shutdown Time	0	Hours (0 – Disabled)
P4-6	Backlight Threshold	LO	Most Sensitive
P4-7	Sigma Audio	OFF	Disabled

Entering Setup Mode

To enter Setup Mode, power down the Model 3000, then turn the unit back ON. Following the display of the Firmware version, when the instrument has begun normal operation, press the MODE button three times (within four seconds) to enter Setup mode.

> **Note:** This process is different if you are in Sigma Mode, rather than in the "click" Mode. While trying to enter Setup Mode from Sigma Mode, once the screen displays the firmware number and then begins counting down, press the Mode button three times as soon as the countdown begins. Do not wait until the countdown is complete, which will prevent you from getting into the Setup Mode. There is no countdown for the "click" Mode.

Entry to Setup Mode can be confirmed when the numeric portion of the display shows P-1, indicating the first setup page is selected. If you simply wish to view the parameters, select the desired Setup Page using the MODE button. Press the UNITS button to advance through the parameters available on the selected Setup Page. To return to normal operation, advance back to the Setup Page selection, and hold the UNITS button for approximately 5 seconds.

SETUP PROTECT: The Model 3000 parameters can be protected from unauthorized changes via the internal switch located on the Model 3000 circuit board. To change the switch, open the battery compartment and remove the batteries from the Model 3000. Next, loosen the six captive pan head screws that fasten the bottom cover.

Gently remove the bottom cover of the instrument. The DIP (dual in-line position) switch should now be visible in the upper left-hand corner of the circuit board.

To protect the Model 3000 from changes in Setup mode, slide DIP Switch 2 (the rightmost switch) to the ON (forward) position. If DIP Switch 2 is in the OFF (back) position, changes are allowed in Setup mode. Once the DIP Switch is set as desired, gently replace the back cover and the six pan head screws. Install the batteries, and replace the battery cover.

Note that with the DIP Switch 2 in the ON position, Setup mode may be entered and parameters viewed, but changes cannot be made.

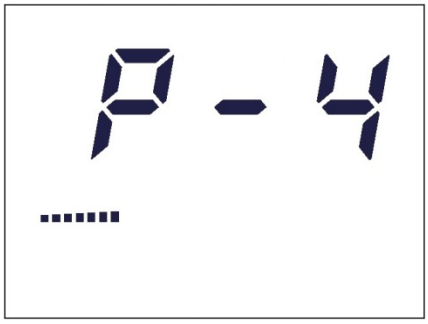
DISPLAY BACKLIGHT 'Continuous On': The Model 3000 display backlight can be set to remain on continuously during operation. Follow the steps above for **SETUP PROTECT**, but use DIP Switch 1 for display backlight selection. Setting DIP Switch 1 to the ON (forward) position will configure the display backlight to remain on during operation. Set DIP Switch 1 to the OFF (back) position, and the display will be backlit only when light levels are low.

NOTE: Setting the display backlight for continuous-on operation can result in reduced battery life.

Setup Mode Operation

Setup Page Selection: Once the Model 3000 is in Setup mode, the Setup Page selection will be displayed on the LCD, and the Page number will be blinking, indicating it as the selected item. The number of available parameters per Setup Page will be displayed using the graph-the number of segments indicating the number of parameters. Use the MODE button to choose the Setup Page. Once the desired Setup Page is shown, press the UNITS button to move to the first parameter of that Setup Page.

Figure 9: Setup Page Selection display (showing page 4).



Pressing and holding the UNITS button, no matter what parameter is shown, will first return the user back to the Page Selection screen. If the UNITS button is then held down for about 4 seconds, the display will exit the Setup Mode.

The list on the following page lists the four setup pages and the parameters, in order, on each page.

Model 3000 List of Parameters (in order)

Page 1 (P-1)

- Calibration Constant Mantissa
- Calibration Constant Exponent
- Dead Time Correction
- Efficiency
- High Voltage Setting
- Pulse Threshold
- Detector Current Overload Threshold
- Loss of Count Alarm Time

Page 2 (P-2)

- Primary Units and Minimum Display
- Primary Units Maximum Display
- Primary Units RATE/MAX Mode Alarm Point
- Primary COUNT Units and Minimum Display
- Primary COUNT Units Alarm Point

Page 3 (P-3)

- Secondary Units and Minimum Display
- Secondary Units Maximum Display
- Secondary Units RATE/MAX Mode Alarm Point
- Secondary COUNT Units and Minimum Display
- Secondary COUNT Units Alarm Point

Page 4 (P-4)

- Response Time
- Auto Response Rate
- Operational Modes
- Count Time
- Auto Shutdown Time
- Backlight Threshold
- Sigma Audio

Setup Parameter Adjustment: Use the MODE button to adjust the value for the selected item. When the appropriate value is selected for that item, press the ON/ACK button to move to the next item. When the desired value is displayed, press the UNITS button to advance to the next parameter. The graph will display the total number of parameters available on the current Setup Page, and the current parameter's position will be blinking. ***When the Model*** 3000 ***is in PROTECT mode (dipswitch setting), the Setup parameters will cycle through to display the set values, but changes are not possible.***

The order of Setup parameters for the Model 3000 is as follows:

Setup Page 1

Calibration Constant Mantissa (Default 200) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Value is used with Calibration Constant Exponent to express counts per R. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**1-9**)

Calibration Constant Exponent (Default 6) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Value is used with Calibration Constant Mantissa to express counts per R. Available values are:

Ones Place (**0-9**)

Tens Place (**0-1**)

Dead Time Correction (Default Varies) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Value is in microseconds. Should be set to zero when checking instrument with pulser or function generator- otherwise higher countrates will result in nonlinearities. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

See the following table for examples with specific detectors.

Detector	Dead Time	Calibration Constant
Model 44-2	10 μsec ±5 μsec	100e+08
Model 44-6	100 μsec ±35 μsec	709e+05
Model 44-7	262 μsec ±35 μsec	139e+06
Model 44-9	85 μsec ±35 μsec	200e+06
Model 44-38	100 μsec ±35 μsec	709e+05

Efficiency (Default 15.0%) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0 or 1)

Normally the efficiency is used on a per detector basis or 4pi basis, i.e. the efficiency of the detector is calculated by dividing the count rate received from a source by the total disintegration rate of the source. When either dpm or Bq units are chosen, the use of the 4pi efficiency allows the display of the source size or activity on the Model 3000 display.

But if the user desires to have the Model 3000 show results in terms of dpm/100 cm^2, the user could manipulate the efficiency to produce this result by multiplying the efficiency times the ratio of the detector area to 100 cm^2. For example, using a detector with an area of 15 cm^2, if we start with 10% efficiency to measure in dpm, then the parameter could be changed to 1.5% to measure in dpm/100 cm^2.

Or likewise for Bq/cm^2, efficiency could be calculated as: efficiency = count rate/disintegration rate*detector area (in cm^2). For example, with the same detector as above with an area of 15 cm^2, and starting with an efficiency value of 15%, then the parameter could be changed to 225% to measure in Bq/cm^2.

High Voltage (Default 900 Volts) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Value is in Volts. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

k Multiplier (**on/off**)

Note: k multiplier also activates left-most decimal point. If k multiplier is used, Hundreds Place value is limited to 0 and 1.

Pulser Threshold (Default 35 millivolts) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Multiplier (**m** or **leftmost decimal**)

Note: multiplier m signifies a value in millivolts. If the multiplier is the left-most decimal, value is in Volts.

Detector Current Overload Threshold (Default 800 microamps) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Setting the Detector Current Overload Threshold to 0 disables the Current Overload Alarm. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Loss of Count Alarm Time (Default 60 seconds) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Setting the Loss of Count Alarm Time to 0 disables the alarm. Value is in seconds. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Setup Page 2

Primary RATE/MAX Units and Minimum Display (Default 0 cpm) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Available values are:

Number of Decimal Places (0, 1, or 2)

Minimum Units – See List Below

cpm	kcpm	cps	kcps	dpm	kdpm	Bq
kBq	μR/h	mR/h	R/h	μSv/h	mSv/h	Sv/h

Primary Units RATE/MAX Maximum Display (Default 999 kcpm) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Units will be the same as selected earlier with Primary Units. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0, 1, or 2)

Range (**k** on or off – cpm, cps, dpm, Bq; μ, m or none for R/h and Sv/h)

Primary Units RATE/MAX Mode Alarm Point (Default 000) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Units will be the same as selected earlier with Primary Units. The ALARM LCD Segment will be on to indicate an Alarm parameter. Set this Alarm Point to 000 to disable. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0, 1, or 2)

Range (**k** on or off – cpm, cps, dpm, Bq; μ, m or none for R/h and Sv/h)

Note: If the Primary Units has changed to a value other than that used to previously set this Alarm Point, the Alarm Point will be reset to 000.

Primary Count Units and Minimum Display (Default 0c) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Available values are:

Number of Decimal Places (0, 1, or 2)

Minimum Units depend on the selected Primary Units– See List Below

Primary Units	Primary Count Units Available
cps kcps	cps c
cpm kcpm	cpm c
Bq kBq	Bq d
dpm kdpm	dpm d

Primary Units	Primary Count Units Available
µR/h mR/h R/h	µR/h µR mR/h mR R/h R
µSv/h mSv/h Sv/h	µSv/h µSv mSv/h mSv Sv/h Sv

Primary Count Alarm Point (Default 000) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Units will be the same as selected earlier with Primary Count Units. Primary Count Units of c or d will not be displayed, but mR or µSv will. The ALARM LCD Segment will be on to indicate an Alarm parameter. Set this Alarm Point to 000 to disable. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0, 1, or 2)

Range (**k** on or off – cpm, cps, dpm, Bq; µ, m or none for R/h and Sv/h)

Note: If the Primary Count Units has changed to a value other than that used to previously set this Alarm Point, the Alarm Point will be reset to 000.

Setup Page 3

Secondary RATE/MAX Units and Minimum Display (Default μR/h) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. Available values are:

Number of Decimal Places (0, 1, or 2)

Minimum Units – See List Below

cpm	kcpm	cps	kcps	dpm	kdpm	Bq
kBq	μR/h	mR/h	R/h	μSv/h	mSv/h	Sv/h

Secondary Units RATE/MAX Maximum Display (Default 9.99 R/h) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. If the Secondary Units is off, this parameter will be skipped. Units will be the same as selected earlier with Secondary Units. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0, 1, or 2)

Range (**k** on or off – cpm, cps, dpm, Bq; μ, m or none for R/h and Sv/h)

Secondary Units RATE/MAX Mode Alarm Point (Default 000) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. If the Secondary Units is off, this parameter will be skipped. Otherwise, units will be the same as selected earlier with Secondary Units. The ALARM LCD Segment will be on to indicate an Alarm parameter. Set this Alarm Point to 000 to disable. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0, 1, or 2)

Range (**k** on or off – cpm, cps, dpm, Bq; μ, m or none for R/h and Sv/h)

Note: If the Secondary Units has changed to a value other than that used to previously set this Alarm Point, the Alarm Point will be reset to 000.

Secondary Count Units and Minimum Display (Default mR) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. If the Secondary Units is off, this parameter will be skipped. Available values are:

Number of Decimal Places (0, 1, or 2)

Minimum Units depend on the selected Primary Units– See List Below

Secondary Units	Secondary Count Units Available
cps kcps	cps c off
cpm kcpm	cpm c off
Bq kBq	Bq d off
dpm kdpm	dpm d off

Secondary Units	Secondary Count Units Available
µR/h mR/h R/h	µR/h µR mR/h mR R/h R off
µSv/h mSv/h Sv/h	µSv/h µSv mSv/h mSv Sv/h Sv off

Secondary Count Alarm Point (Default 000) - Use ON/ACK to select the value to adjust, and MODE to adjust the value. If the Secondary Units is off, this parameter will be skipped. Otherwise, units will be the same as selected earlier with Secondary Count Units. The ALARM LCD Segment will be on to indicate an Alarm parameter. Set this Alarm Point to 000 to disable. Available values are:

Ones Place (**0-9**)

Tens Place (**0-9**)

Hundreds Place (**0-9**)

Number of Decimal Places (0, 1, or 2)

Range (**k** on or off – cpm, cps, dpm, Bq; µ, m or none for R/h and Sv/h)

Note: If the Secondary Count Units has changed to a value other than that used to previously set this Alarm Point, the Alarm Point will be reset to 000.

Setup Page 4

Response Time (Default 0 - auto) – Use ON/ACK to select the value to be adjusted and MODE to adjust the value. Setting the Response Time to a fixed value is useful primarily when performing surveys to a fixed MDA (Minimum Detectable Activity) level. Setting the Response Time to 0 will enable the Auto-Response mode for the Model 3000 (see the next parameter). Available values for the Response Time (in seconds) are:

Ones Place (**0-9**)

Tens Place (**0-6, 6** forces max Response Time of 60)

Auto-Response Rate (Default S) - Use MODE to select Fast (**F**) or Slow (**S**).

When operating in Auto-Response mode, the Model 3000 will vary the Response Time based on the Auto-Response Rate selected (**F**ast or **S**low) and the current Count Rate. The following table shows the response time for different count rates when these auto response modes are chosen:

Count Rate	Auto Response Time – Fast (Seconds)	Auto Response Time – Slow (Seconds)
Less than 3 kcpm (50 cps)	10.5	21
Between 3 kcpm and 4 kcpm (67 cps)	8.4	16.8
Between 4 kcpm and 6 kcpm (100 cps)	6.3	12.6
Between 6 kcpm and 12 kcpm (200 cps)	4.2	8.4
More than 12 kcpm	2.1	4.2

The Model 3000 also utilizes a Step function in Auto Response mode, which enables faster response to a significant increase or decrease in Count Rate. When the instrument detects a sudden change in count rate from the detector, the response time is reduced to 1 second to quickly show the new value.

Operational Modes (Default 0 - All modes available) - Use MODE to adjust the value. Available values are:

0 – RATE, MAX, and COUNT Modes

1 – RATE and MAX Modes only

2 – RATE and COUNT Modes only

3 – RATE Mode only

Count Time (Default 1 minute) - Use ON/ACK to select the value to adjust and MODE to adjust the value. Setting Count Time to 0 enables continuous count until reset. If 9 minutes are selected, then the maximum seconds value is 60; otherwise, the maximum seconds value is 59. Available values are:

Ones Place (**0-9**)

Tens Place (**0-6, 6** only available if minutes value is 19)

Hundreds Place (**0-9**)

Note

The UNITS button can be used to advance to the next parameter. To send Setup mode and save the current setting, press and hold the UNITS button for approximately 5 seconds.

Auto Shutdown Time (Default 0 - off) - Use MODE to adjust the value. Setting Auto Shutdown Time to 0 disables Auto Shutdown. Available values are:

Ones Place (**0-9**) hours

Backlight Threshold (Default LO –most sensitive) - Use MODE to adjust the value. Available values are:

LO – Backlight comes on at a higher ambient light level

HI – Backlight comes on at a lower ambient light level

OFF – Disables backlight

Sigma Audio (Default OFF) - Use MODE to adjust the value. Available values are:

ON – Sigma Audio Enabled

OFF – Sigma Audio Disabled (Normal 'Click' Audio active)

Note

The Sigma Mode may not work properly until the 8-second background is completed. If the 8 second background count is too low, the device will continually beep until an acceptable background count rate is obtained.

Section

5

Safety Considerations

Environmental Conditions for Normal Use

Indoor or outdoor use (While rain resistant, user is cautioned to avoid getting water through detector opening.)

No maximum altitude

Temperature range of -40 to 65 °C (-40 to 150 °F)

Maximum relative humidity of less than 95% (non-condensing)

Pollution Degree 3 (as defined by IEC 664): (Occurs when conductive pollution or dry nonconductive pollution becomes conductive due to condensation. This is typical of industrial or construction sites.)

Not certified for use in an explosive atmosphere

Warning Markings and Symbols

Caution!

The operator or responsible body is cautioned that the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by Ludlum Measurements, Inc.

The Model 3000 Survey meter is marked with the following symbols:

CAUTION (per ISO 3864, No. B.3.1): designates hazardous live voltage and risk of electric shock. During normal use, internal components are hazardous live. This instrument must be isolated or disconnected from the hazardous live voltage before accessing the internal components. This symbol appears on the side panel. Be sure to take the precautions noted in the next section whenever necessary.

Caution!

Verify instrument voltage input rating before connecting to a power converter. If the wrong power converter is used, the instrument and/or power converter could be damaged.

The "**crossed-out wheelie bin**" symbol notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding. Each material must be separated. The symbol is placed on the label located on the side panel. See section 7, "Recycling," for further information.

The "CE" mark is used to identify this instrument as being acceptable for use within the European Union.

Cleaning and Maintenance Precautions

The Model 3000 may be cleaned externally with a damp cloth, using only water as the wetting agent. Observe the following precautions when cleaning or performing maintenance on the instrument:

1. Turn the instrument OFF and remove the batteries.

2. Allow the instrument to sit for one minute before cleaning the exterior or accessing any internal components for maintenance.

Section

6

Revision History

NOTE: *This section of the manual will be updated with each revision of the Model* 3000 *in order to document changes over time. Ludlum Measurements' policy is to provide free software upgrades to instruments for the life of the instrument.*

December 2013: New manual.

May 2014: Added HV range, Threshold range, and maximum load on supply to Specifications, Section 3.

July 2014: Added standard parts list, Section 8. Added note about foam grip in Intro. Added sentence on page 4-6 about setting DTC to zero when checking with pulser.

September 2014: In second paragraph on page 4-4, corrected "Mode" button to "Units" button twice. Also changed to hold down button for 4 seconds instead of 3. Updated ON/ACK and AUDIO button operational descriptions to reflect Sigma Audio operation. On page 3-1 changed ON/OFF/Quiet button to ON/OFF/ACK.

November 2014: Added a note explaining entering Setup Mode while in Sigma Mode on page 4-3. Added a note on page 4-14 regarding the audio and background.

December 2015: Added description of headphone option. Corrected the location of the low-battery indicator. Updated the table on page 4-13. Removed "Units selected as Primary will not be available as Secondary" on page 4-11.Updated Sigma Audio Note on page 4-14.

Section

7

Recycling

Ludlum Measurements, Inc. supports the recycling of the electronics products it produces for the purpose of protecting the environment and to comply with all regional, national, and international agencies that promote economically and environmentally sustainable recycling systems. To this end, Ludlum Measurements, Inc. strives to supply the consumer of its goods with information regarding reuse and recycling of the many different types of materials used in its products. With many different agencies – public and private – involved in this pursuit, it becomes evident that a myriad of methods can be used in the process of recycling. Therefore, Ludlum Measurements, Inc. does not suggest one particular method over another, but simply desires to inform its consumers of the range of recyclable materials present in its products, so that the user will have flexibility in following all local and federal laws.

The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

Batteries	Glass	Aluminum and Stainless Steel
Circuit Boards	Plastics	Liquid Crystal Display (LCD)

Ludlum Measurements, Inc. products that have been placed on the market after August 13, 2005, have been labeled with a symbol recognized internationally as the "crossed-out wheelie bin," which notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding. Each material must be separated. On the Model 3000, the symbol will be placed on the serial number label located on the side of the instrument.

The symbol appears as such:

Section

8

Standard Parts List

Part Description	**Part #**
Model 3000 Digital Survey Meter	48-4035
Model 3000 Main Board	5498-440
LCD 82 mm x 61.64 mm	7498-417
Unimorph with Harness	8498-542
Model 3000 Bezel Assembly	4498-412
Main Keypad Membrane Switch	7498-414
Battery Holder Modified	7498-458
Model 3000 Headphone Option	4498-555